PORTLAND CEMENT.[1]

M. LEDUC has made a notable contribution to the literature of a subject which already possesses *matériel* more remarkable for quantity than merit, and, departing from topical traditions, has given us many useful data with few speculations.

An excellent historical preamble is succeeded by a description of the methods which he employed in his endeavour to throw light on the constitution of cement—a question which is taxing, and will continue to tax, the best efforts of the chemist, equipped as he must be with ample knowledge of physical methods of research. Provision of a suitable apparatus for working at high temperatures with relatively large quantities of material, say a couple of kilogrammes, needed much thought and many trials, and was attained by the device of a furnace heated by three burners fed with gas and air under pressure, these playing below the hearth on which the test pieces are placed and the gases being deflected back above the hearth before reaching the flue, so that as uniform a temperature as could be expected from any contrivance heated by fuel was secured. In many instances of this sort where the experimenter finds himself in a difficulty useful recourse may be had to some industrial apparatus, and M. Leduc, fully alive to this, used one originating with a famous firm of motor manufacturers, and records the result with a touch of sadness:—"Enfin, dans un essai qui, malheureusement, s'est terminé par la fusion complète et le mélange d'un grand nombre d'échantillons, j'ai utilisé le four à porcelaine dure de la maison de Dion-Bouton, que M. Guillet, professeur au Conservatoire des Arts et Métiers, avait bien voulu mettre à ma disposition."

The author prepared the first of the calcium silicates which may occur from the interaction of cement raw materials, that is, wollastonite, $CaOSiO_2$, and notes in passing that the product had a pale-green tint, which he attributes to the presence of a trace of iron. Seeing that the silicate is relatively acid, the reviewer would not care to contest this explanation, but he would point out when white Portland cement, necessarily a far more basic material, is made from the purest materials obtainable in commerce as distinct from strictly laboratory products, it also possesses a pale-green tint, and that this tint is due, not to iron, but to manganese, probably present as calcium manganate. Dicalcium silicate, that is, the orthosilicate, $2CaOSiO_2$, was also made with ease, as other experimenters have established; but, again confirming earlier results, the preparation of that illusive body $3CaOSiO_2$ proved to be impracticable. So far as we know the only successful attempts have been those of Le Chatelier some twenty-five years ago, in which not pure $3CaOSiO_2$ but a body in which part of the CaO is replaced by $CaCl_2$ was prepared, and the recent work of Shepherd and his collaborators, who have shown that tricalcium silicate has a small range of stability in respect of temperature, and it is in consequence of this that its existence as an individual substance has been so much and so justly doubted.

M. Leduc's conclusions are such that we will quote them without fear of the accusation of laziness properly levelled at commentators on other men's work.

$CaOSiO_2$ has no hydraulic properties; neither has $2CaOSiO_2$, which can only be made in the dry way, and is decomposed by water into the monocalcium silicate and lime. $3CaOSiO_2$ has not been prepared. $CaOAl_2O_3$ and $2CaOAl_2O_3$ are hydraulic and stable in hot water. $3CaOAl_2O_3$ has not been obtained. The calcium-ferrites are not hydraulic, and no silico aluminates or silico-ferrites containing a high percentage of lime could be prepared, the products falling to powder on cooling in the manner characteristic of dicalcium silicate.

Concerning commercial cements, the fact recognised in practice, that the mechanical strength falls off rapidly as the content of clay is increased, is confirmed, and it is also shown that the coarseness of grain of both clayey matter and of sand has at least as large an influence on the "falling" of clinker as has the amount of their constituents. A normal clinkering temperature is set down at 1400–1450° C. Cements in which the alumina is replaced by ferric oxide are mechanically weak, and those containing considerable quantities of magnesia, *e.g.* 25 per cent., went to pieces when exposed to steam. It should be noted that M. Leduc took unusual pains to bring his raw materials to an extremely fine state of division, fully comprehending that in a mass which is almost plastic the occurrence and completion of the reactions concerned in the production of definite silicates, aluminates, and the like are dependent on the intimacy of admixture, as well as on the temperature and the time. Anyone who has prepared Portland cement experimentally knows that particles of sand which may be only 1/10 mm. in diameter will each produce its small centre of "falling," the dicalcium silicate oozing forth from the site of the grain in a very curious lifelike and vermiform manner, whereas the same raw materials, really finely ground, will not "fall" at all.

One more word, and we will close an appreciation of good work well done. M. Leduc has shown, in collaboration with M. Chenu, that Seger cones, useful as they are for many industrial purposes, are far from exact as indicators of temperature. They may well be used side by side with materials of the same class which are to be heated in the same way, but in all cases they must be checked by whatever kind of pyrometer is best adapted for the temperatures to be measured. Failing this the most careful inquiry may be misleading.

B. B.

PLAGUE IN INDIA.

THE sixth report on plague investigations in India, which, like preceding reports, has this year been issued as a supplement to *The Journal of Hygiene*, is in large part made up of a continuation by Dr. M. Greenwood of the statistical examination of plague as it occurs in the Punjab. In the application of statistical methods to a subject-matter so complex it is a considerable advantage to the investigator to have himself personal experience of the methods, particular conditions, and so on affecting the collection of the data with which he has to deal, and adds cogency not so much to the facts elucidated as to the conclusions based upon these facts. It is particularly unfortunate, therefore, that the death of Major Lamb deprived Dr. Greenwood of the assistance which his wide experience and knowledge of local circumstances would have afforded. Major Lamb, of whom a memoir is included in the report, was one of the most brilliant members of the Indian Medical Service, and his untimely death in this country has taken from plague research in India one of the ablest, keenest, and at the same time best-informed of its students.

In the Punjab cases of plague continue to occur, though in reduced numbers, during the off-season, and this persistence is met with chiefly in the larger villages. Dr. Greenwood's first paper is a contribution to the question whether in the smaller villages

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[1] "Sur la constitution et la formation du ciment Portland." By E. Leduc. Bull. Soc. d'Encouragement, Paris, November, 1911.

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the seasonal outbreak should be looked on mainly as a reimportation of the disease from these larger centres or as an independent development of a local focus dormant during the off-season. If the former were the case, we might expect a larger incidence in the villages near the main lines of communication, and taking the Amritsar district as the area for investigation and the railways as the means of communication, Dr. Greenwood finds that in districts containing large centres, villages near a line of railway are, in fact, subject to a higher rate of plague epidemics than villages not so situated, while in districts purely or mainly agricultural, proximity to railways does not increase the liability. The greater liability in the former case is probably due to increased opportunity for personal intercommunication rather than to transport of merchandise, and he concludes that in districts favourably situated for such intercourse the spread of plague can be better explained on the hypothesis of reimportation than on that of recrudescence. The second paper bears on the problem of what circumstances determine the extent of an epidemic when plague has once shown itself, and why the mortality-rates in infected villages are subject to the variations actually observed. Dr. Greenwood is fully alive to the necessity of caution in accepting statistical conclusions based on the material at his disposal, and we give the barest indication of his results in saying that the rate of plague mortality is seen to depend on three factors: the length of exposure to infection, the number of inhabitants, and the situation of the village.

Besides some observations on the breeding of *Mus rattus* in captivity, and a summary of some recent observations on rat fleas, the report includes an interesting account of plague as it occurs in Eastern Bengal and Assam. This province has suffered from the present epidemic to only a limited extent, and the report, which is liberally illustrated by photographs, attributes this freedom chiefly to the scarcity of rats in the Bengali houses, a scarcity due both to the habits of the people and the structure of their houses. Two important papers by Dr. Rowland are sent from the research laboratory of the Advisory Committee, dealing respectively with a possible improvement in the preparation of plague-serum and with some of the problems connected with plague-vaccine. From the second of these it appears that it may prove practicable to obtain a vaccine of low toxicity, but undiminished immunising power, a result which if confirmed has a theoretical as well as practical significance not confined to plague only, but affecting the general question of immunity in infectious disease.

FOUR MAMMAL SURVEYS.

FOUR papers which have recently reached us serve to show the energy and vigour with which the collecting of mammals is being carried on in various parts of the world. If continued at the same rate for a few years longer, such surveys ought to go a long way towards completing our knowledge of the mammalian fauna of the globe, so far at least as external and cranial characters are concerned.

The first of the four papers is a report on the progress of the Indian mammal survey now being carried on under the supervision of the Bombay Natural History Society, in the Journal of which for October, 1911, the report is published. Collecting has been carried on in Kandesh and the Berars, where about 150 skins have been obtained. Apparently none of these represents new forms, thereby bearing testimony to the thorough manner in which collecting (for the most part amateur) has been previously carried on in this part of the country. Interesting results in regard to the geographical distribution of species and the occurrence of local races are, however, expected in the future.

To vol. iv., parts iii. and iv., of the Journal of the Federated Malay States Museums, Mr. C. Boden Kloss communicates an account of the results of a recent visit to the Trengganu Archipelago in search of mammals and other vertebrates. The chain of small islands, of which Great Redang and the Perkentians are the chief, runs at a distance of from seven to twelve miles from the coast of the Malay Peninsula in a nearly parallel direction for about thirty miles. The only previous visit of naturalists to the archipelago appears to have been made by the members of the Skeat expedition in 1899. During an eighteen days' cruise Mr. Kloss obtained thirteen mammals which he regards as representing new forms; all these were named in the *Annals and Magazine of Natural History* for January, 1911.

The penultimate number of the Proceedings of the Zoological Society for 1911 contains the fourteenth report by Mr. Oldfield Thomas on mammals from eastern Asia, collected with the aid of funds furnished by the Duke of Bedford. This particular fasciculus deals with mammals from Shen-si, the most interesting of these being the golden takin (*Budorcas bedfordi*), to which reference has been previously made in these columns, but the whole survey, despite the fact that no strikingly new forms were discovered, has vastly increased our knowledge of the mammal fauna of Eastern and Central Asia. It is, therefore, a matter for regret that it is not to be continued, at all events for the present.

The fourth paper, "Notes on the Mammals of the Lake Maxinkuckee Region," by Messrs. B. W. Evermann and H. W. Clark (Proc. Washington Acad. Sci., vol. xiii., pp. 1–34), is of a totally different type from the above, dealing solely with the habits and environment of the mammals met with during a zoological survey of the region, and is an excellent sample of the best class of American work of this nature. Particular interest attaches to the reappearance of the opossum in the district, from which it had long been absent.

R. L.

TREASURY GRANTS TO UNIVERSITIES AND UNIVERSITY COLLEGES.

THE report of the Advisory Committee on the distribution of Exchequer grants to universities and university colleges in England, appointed by the President of the Board of Education last June, has now been published [Cd. 6140]. The committee as then appointed consists of seven members:—Sir W. S. McCormick (chairman), Prof. J. A. Ewing, C.B., F.R.S., Sir William Osler, F.R.S., Miss Emily Penrose, Sir Walter Raleigh, Sir John Rhys, and Sir Arthur Rücker, F.R.S., with Mr. G. M. Young as secretary.

The report states that in framing its recommendations for the distribution of the Exchequer grant, the committee has chiefly had regard to three factors—the needs of the several colleges, the amount of local support received by each, and the volume and quality of their work.

For the purpose of the present report the members of the committee have visited all the colleges coming within their purview except Nottingham, in considering which the committee had before it the report of the recent inspection conducted by the Board of Education. As a result of the visits to the various institutions, the committee says that the colleges gener-

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